

Endodontic management of a rare combination (intrusion and avulsion) of dental trauma

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Abstract – Combined trauma involving intrusive luxation of one tooth and avulsion of another is rare. A case is presented involving the endodontic management of two traumatised maxillary central incisors, one of which was intrusively luxated and the other avulsed. Spontaneous re-eruption of the intruded tooth occurred, thereby avoiding the need to further traumatise the periodontal ligament with either orthodontic or surgical repositioning, and allowing endodontic therapy to be carried out uneventfully. Endodontic therapy of the avulsed tooth was completed and its prognosis is considered good.

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Tooth avulsion, total displacement of a tooth out of its socket, is an infrequent injury, seen in 0.5–16 per cent of traumatic injuries (1). Maxillary central incisors are the teeth most commonly involved (2) and the injury is usually observed in children between the ages of 7 and 9 years of age when the central incisors are erupting, as the periodontal ligament provides only minimal resistance to an extrusive force (1).

A luxation injury is defined as a tooth being partially displaced out of its socket (1); this can involve either the tooth being concussed, subluxated, extruded out of its socket, laterally displaced or intruded deeper into alveolar bone. Intrusive luxations have received relatively little attention in the literature compared with other types of trauma such as fracture and avulsion (3); Andreasen (4), in a retrospective study of the aetiology and pathogenesis of traumatic dental injuries, found that of 2239 injured permanent teeth, only 3 per cent were intrusively luxated.

Dental injuries usually affect only a single tooth (5); certain types of trauma, however, such as automobile accidents or sports injuries, may more frequently involve multiple teeth (4). Luxation injuries frequently involve 2 or more teeth, with crown fractures being the associated injury (1), while avulsions usually involve a single tooth (1). The occurrence of a com-

bined injury of both an avulsed and an intrusively luxated tooth is extremely rare. Andreasen (4) has studied the association between types of injury to different teeth and found that of 40 intrusively luxated teeth, no associated teeth were observed to have avulsed while of 196 avulsed teeth, no teeth had been intrusively luxated.

This case report describes the management of a rare combined dental traumatic injury, involving the avulsion of one maxillary central incisor and the intrusive luxation of the other.

Case report

In May 1994, a 10-year-old boy was referred to the Emergency Department of the Royal Dental Hospital of Melbourne following a bicycle accident. On presentation, the child had laceration injuries to his gingivae from tooth 12 to 22 as well as an avulsed 11 and intrusively luxated 21, of which there was an uncomplicated crown fracture involving enamel and dentine; radiographically, both teeth appeared to have closed apices and tooth 21 was noted to have been intruded approximately 2–3 mm. The avulsed tooth had been out of the mouth for two and a half hours but had been stored immediately in milk. Emergency

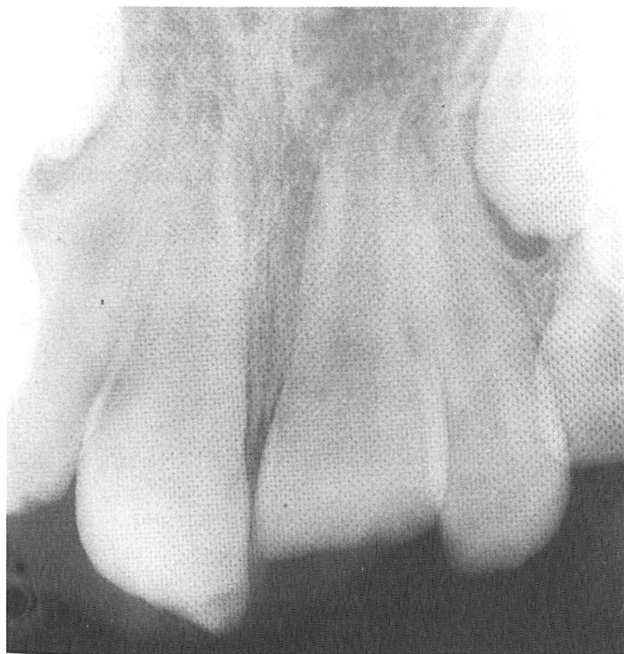


Fig. 1. Radiograph of maxillary central incisors following replantation of avulsed 11. Note the intruded 21 and accompanying uncomplicated crown fracture.

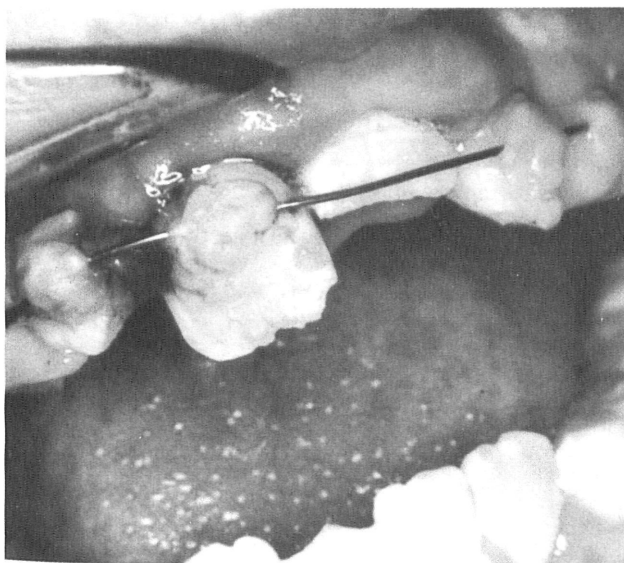


Fig. 2. Photograph of light wire splinting following repositioning of avulsed 11 not incorporating the intruded 21.

treatment at the time involved rinsing the avulsed tooth in saline, repositioning it in its socket (Fig. 1) followed by light wire splinting which did not incorporate the intruded tooth (Fig. 2).

The child was examined 11 days later and neither tooth 11 nor 21 was tender to percussion, and both were negative to dry ice testing. The splint was removed and the pulp extirpated from tooth 11 which

was subsequently dressed with Ledermix (Lederle Laboratories, Wolfratshausen, Germany) paste for three months. The intruded 21 exhibited both 6 mm pocketing on the distolabial aspect and class 1 mobility while a normal percussion tone (as distinct from a high-pitched tone associated with ankylosis) was noted. Very little crown was visible clinically and exposed dentine was evident. It was decided not to reposition tooth 21 surgically at this stage but to allow some time for possible spontaneous re-eruption. Endodontic treatment was deferred for tooth 21 as it was deemed impossible to successfully isolate and access the tooth.

The patient was then reviewed at two, four, eight and twelve weeks. At each recall visit mobility, percussion and CO₂ vitality tests of tooth 21 were carried out. Mobility and percussion tones were normal while no response was obtained with the CO₂ tests during the first two months but at the third month there was a delayed response. Clinically, tooth 21 was slowly re-erupting.

Approximately four months after the accident, tooth 21 was observed to have continued to erupt, while tooth 11 had discoloured, evident after the four month Ledermix dressing (Fig. 3); the Ledermix dressing in tooth 11 was replaced with calcium hydroxide which was left for two weeks (Fig. 4), after which the tooth was obturated with gutta-percha and AH26 (de Trey Dentsply, Zurich, Switzerland) sealer cement. At this stage, tooth 21 still responded slowly to CO₂.

The patient was not seen again for a further 3 months, since he was overseas. At this time, tooth 21 was not responding to CO₂ and radiographically a

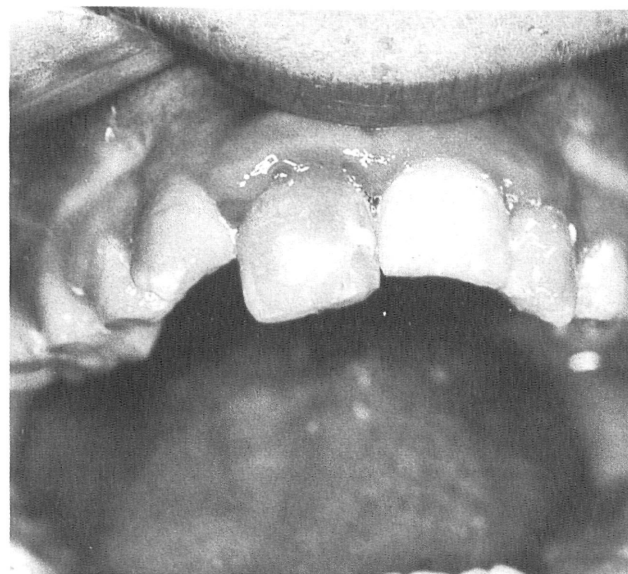


Fig. 3. Photograph four months post-trauma. Note discoloured 11 following dressing with Ledermix paste.

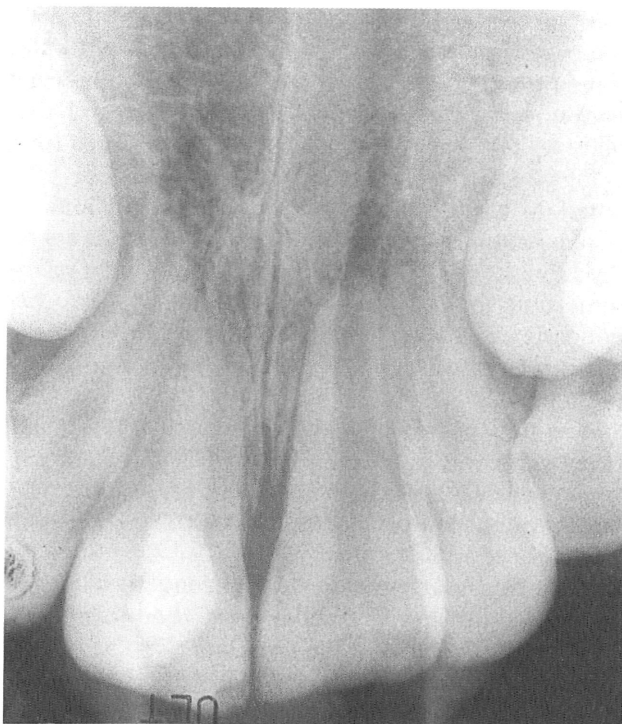


Fig. 4. Radiograph four months post-trauma. Tooth 21 was slowly re-erupting and also responded to pulp testing.



Fig. 5. Radiograph of root filled 11 and a periapical lesion had developed associated with re-erupted 21 – seven months post-trauma.

periapical radiolucency was evident (Fig. 5). Endodontic treatment was recommended utilising a dressing of calcium hydroxide prior to placing the root ca-

nal filling while surface resorption defects were noted on the mesial aspect of tooth 11 fourteen months after the accident (Fig. 6). The re-eruption of tooth 21 allowed normal isolation and access procedures to be used. Additionally, tooth 11 appeared to have responded well to the root canal treatment and bleached satisfactorily (Fig. 7).



Fig. 6. Radiograph 14 months post-trauma showing periapical healing associated with 21.



Fig. 7. Photograph 16 months post-trauma showing pleasing aesthetic result following bleaching of 11 and complete re-eruption of 21.

Discussion

The combination of intrusive luxation of one tooth and avulsion of another is rare, as illustrated by Andreasen's material (4). The reason for this uncommon occurrence may lie with the different mechanisms of injury associated with these two types of trauma; although exact mechanisms are as yet unknown (1), it is agreed that intrusive luxations are the result of a direct impact on the incisal edge in an axial direction and the energy in this form of impact can be expended to crown fracture (4), while avulsions will result following a blunt impact associated with the high resilience of tooth supporting structures.

In a prospective study of 637 luxated permanent teeth (6), it was found that the type of injury and stage of root development had a significant effect on predisposition to pulp necrosis. The diagnosis of pulp necrosis following luxation injuries can be difficult, as lack of pulpal response to CO₂ or electric pulp testing (7) or coronal discolouration (7) are not enough to confirm pulp necrosis; it has been noted, though, that if a pulpal response changes from positive to negative, pulp necrosis should be strongly suspected (1), as observed in the case presented. Radiographic periapical changes, once considered the only 'safe' form of diagnosis, have recently been questioned, as luxation injuries exhibiting all of the above three signs have been followed by pulp repair (8). In the study cited above (6), 85% of intrusive luxations subsequently developed pulp necrosis, more than any other type of luxation injury; it was also found that pulp necrosis may be diagnosed up to two years following an intrusive luxation injury.

The optimal treatment for an intrusively luxated tooth has yet to be determined. Shapira et al. (9) have suggested that there are three options available to the dental practitioner: *a*) await spontaneous re-eruption (especially in immature cases) *b*) immediate surgical reduction and fixation or *c*) orthodontic repositioning. Andreasen (10) has stated that immature teeth will re-erupt spontaneously, while surgical repositioning of mature teeth is not advisable as this procedure may lead to extensive marginal bone loss. Turley et al. (11) have investigated spontaneous re-eruption and orthodontic extrusion as options for experimentally intruded permanent teeth in dogs. Less severely intruded and mobile teeth responded well to orthodontic extrusion while the deeply embedded teeth became ankylosed and failed to respond. The more conservative option of observation was decided on in the case reported here, as endodontic intervention was not deemed immediately necessary. The tooth was carefully monitored for continuing signs of mobility and its re-eruption was observed in the three month period post-trauma; if endodontics had been required earlier, gingival surgery (9) or orthodontic

repositioning (11) to provide access to the pulp may have been employed. Calcium hydroxide was deemed the medicament of choice in the endodontic treatment of tooth 21, as Andreasen (12) has reported that external root resorption is a common sequela to pulp necrosis associated with intrusive luxations.

Both the pulp and periodontal ligament suffer extensive damage following tooth avulsion. It is generally agreed that following avulsion of a tooth with a fully formed root, the root canal be instrumented and the pulp removed; most necrotic pulps of avulsed teeth become infected (13). It has also been found that immediate pulp extirpation following replantation can be detrimental to the long term healing of the periodontal ligament (14); thus, the tooth should be replanted and splinted in such a way as to allow physiologic mobility to assist in periodontal ligament repair (15), deferring endodontic treatment for one week. Medicating the canal with Ledermix for three-four months rather than calcium hydroxide was decided in this case in accordance with the Australian Society of Endodontics (ASE) guidelines. It should be noted, however, that the tooth became markedly discoloured over the four month period.

Although the avulsed tooth in the case presented was out of the mouth for two and a half hours, it had been stored in milk for the duration prior to replantation. Blomlöf et al. (16), in a monkey study, have found that storage of teeth in milk for three hours before replantation produces similar small amounts of root resorption as teeth that are immediately replaced. Fourteen months after the accident, areas of surface resorption associated with a normal PDL space were noted on the mesial aspect of the avulsed 11 and on the distal aspect of the intruded 21 (Fig. 6).

In conclusion, the combined trauma of intrusion of one tooth and avulsion of the other is rare and the mechanisms responsible for this event are intriguing. The avulsed incisor was treated endodontically while the intruded incisor, with careful clinical monitoring, was allowed to spontaneously re-erupt, which avoided the need to reposition the tooth either orthodontically or surgically.

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